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Stanford Peds Housestaff Card

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Note: This card contains guidelines and recommendations based on published information. Specific medications, doses, and techniques may be adjusted based on patient condition and clinician judgement. This card is to be used only by clinicians with appropriate experience, training, and supervision. This card is not meant to be a comprehensive guide to therapy.

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Code/Rapid x211

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Vitals, Measures, Equipment by Age

	Term*	1-6mo	6-12mo	2y	4y	6y	10y	14y	18y
HR	95–160	120–170	110–150	90–150	80–130	70–115	65–110	60–100	55–100
RR	40–60	25–40	25–40	20-30	20-25	15-25	15-25	10-20	10-20
SBP^	80–95	85–105	85–100	85–105	90–105	90–110	95–115	100–120	110–120
UOP *(mL/kg/hr)*	≥2-3	≥2		≥1.5	≥1			≥0.5	
Bladder Capacity *(mL)*	30–84	46–131	71–203	105–301	139–397	164–467	201–573	<650	<700

* 0–7 days of life

^ Adjust for height/gender/age. Ben Solomon's BP calculator: http://bit.ly/Pedi_BP

SBP ≥ 65 + (2 x Age[yrs]) MAP ≥ 40 + (1.5 x Age[yrs]) — 5th percentile

PMID: 17273118

Δ Bladder Capacity (oz.) = 4.5 x [Age (yrs)$^{0.6}$] *(PMID 9366371, not validated ≥ 14yo).* 1oz = 29.6mL

	Term*	1-6mo	6-12mo	2y	4y	6y	10y	14y	18y
Wt *(kg)*	3.5	7	10	12	16	22	35	50+	50+
ETT size *uncuffed*	3-3.5	3.5-4	4-4.5	4-4.5	5-5.5	5-5.5	6-6.5	7	7-8
ETT to gum *(cm)*	9	11	12	13	15	16	18	21	20–22
Blade Type	Miller				Miller or Macintosh			Usually Mac	
Blade Size	1	1	1–1.5	1–2	1.5–2	2	2–3	3	3–4
LMA	1	1	1 - 2	1.5–2	2	2.5	3	4	5
NG *(Fr)*	8	8	8–10	10	10-12	12	14	16	18
Suction cath *(Fr)*	8	8	8	8	10	10	12	12	12–14
Foley *(Fr)*	5	6	8	8	10	10	12	12	12

$ 1/2 size down for cuffed tube

Modified Glasgow Coma Score

		Infant	Child/Adult
Eye	4	Spontaneous	Spontaneous
	3	Only to speech	Only to speech
	2	Only to pain	Only to pain
	1	No response	No response
Verbal*	5	Coos and babbles	Oriented, appropriate
	4	Irritable, cries	Confused
	3	Cries to pain	Inappropriate words
	2	Moans to pain	Incomprehensible
	1	No response	No response
Motor	6	Moves spontaneously	Follows commands
	5	Withdraws to touch	Localizes to pain
	4	Withdraws to pain	Withdraws to pain
	3	Decorticate posturing (flexion)	Decorticate posturing (flexion)
	2	Decerebrate posturing (extension)	Decerebrate posturing (extension)
	1	No response	No response

* If patient intubated, score Verbal section 1T, *eg* E4 V1T M6, or 11T

Intubation Sequences

Pre-intubation

Monitors, 100% FiO2 for >2-3min, PIV, suction, ETCO2, oral airway, alternative ETT and blades. Have NS bolus available if Pt has ↓ BP with PPV.

Standard Sequences

– *Consider premedication for children < 5yr (2.5 min before laryngoscopy)*
  - ▹ Atropine 0.02 mg/kg IV [≤ 0.5mg] *or* Glycopyrrolate 4–10 mcg/kg [≤ 100-200mcg]
– Sedation:
  - ▹ *Option 1*: Fentanyl 1–2 mcg/kg IV [≤100mcg] *and* Midazolam 0.1–0.2 mg/kg IV [≤ 5mg]
  - ▹ *Option 2*: Ketamine 1–2 mg/kg IV
  - ▹ *Option 3*: Propofol 1–2 mg/kg IV
– Neuromuscular Blockade:
  - ▹ Rocuronium 0.6–1.2 mg/kg

Special Cases

– Head injury: Consider lidocaine premedication 1-1.5 mg/kg IV, *then* Etomidate 0.3 mg/kg IV *or* propofol 1-2 mg/kg IV
– Asthma: Ketamine 1-2 mg/kg IV
– Hemodynamic instability: Ketamine 1-2 mg/kg IV *or* Etomidate 0.3 mg/kg IV

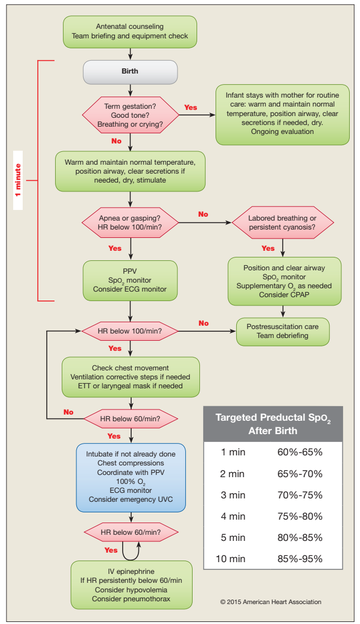
Sedation, Analgesia, Amnesia

	Dose (IV)	Kinetics	Dose (other)	Notes
Opioids				
Morphine	0.05–0.2 mg/kg [≤4 mg] *gtt*: 0.025–0.2 mg/kg/hr [≤2-20 mg/hr]	Peak 20 min Duration 4 hr		*Pro*: Experienced use, including EOL care *Con*: Histamine release (vasodilation and pruritis)
Hydromorphone (Dilaudid)	0.003–0.015 mg/kg [≤0.4-1mg] *gtt*: 10-50 mcg/kg/hr [≤0.5-3 mg/hr]	Peak 10-20 min Duration 4 hr	Initial PCA settings: *Demand*: 2-4 mcg/kg [≤200mcg] *Lockout*: 8 minutes *Basal rate*: 1 mcg/kg/hr [≤50 mcg/hr]	*Pro*: Longer acting than fentanyl *Con*: Slower onset than fentanyl
Fentanyl	0.5–2 mcg/kg [≤50-100mcg] *gtt*: 1–5 mcg/kg/hr [50-200 mcg/hr]	Peak 5 min Duration 1-2 hrs	Intranasal: 1.5-2 mcg/kg	*Pro*: Fast. Minimal ICP, CV changes. No histamine release *Con*: Chest wall rigidity (give if pushes slowly). Distributes to tissue. Avoid in ECMO
Benzos				
Lorazepam	0.05–0.1 mg/kg [≤2-4mg]	Peak 15 min Duration 6 hr	IM: 0.05 mg/kg [≤4mg] PO: 0.05-0.1 mg/kg [≤2mg]	*Pro*: Anti-Sz *Con*: ↓ airway tone
Midazolam	0.1 mg/kg [≤2-5mg] *gtt*: 0.025–0.3 mg/kg/hr [≤2-4 mg/hr]	Peak 5 min Duration 60 min	IM: 0.1-0.15 mg/kg Intranasal: 0.2 mg/kg PO: 0.5 mg/kg	*Pro*: Minimal ICP changes. Anti-Sz *Con*: ↓BP, ↓ airway tone
Dexmedetomidine (Precedex)	*gtt*: 0.2–1.5 mcg/kg/hr	Peak 5-10 min *(with loading dose)* Duration 1-2 hrs	Intranasal: 0.5-2 mcg/kg	*Pro*: No ↓RR *Con*: ↓HR, ↓BP at high doses. Avoid in heart block
Ketamine	0.5–1 mg/kg *gtt*: 0–1 *mg/kg/hr* 5–20 *mcg/kg/min*	Peak 5 min Duration 1-2 hrs	IM: 3-7 mg/kg Intranasal: 1.5 mg/kg [≤ 100 mg]	*Pro*: No ↓RR Bronchodilator *Con*: ↑ secretions
Propofol	1–4 mg/kg *gtt*: 20–200 mcg/kg/min	Peak 1 min Duration 10 min		*Pro*: Fast. Anti-Sz. Amnesia *Con*: ↓BP. Rare but fatal Propofol Infusion Syndrome. No analgesia. Avoid if soy/egg allergy or ketogenic diet

APGAR

	0	1	2
Appearance (color)	Blue or Pale	Acrocyanotic	Completely pink
Pulse	Absent	<100 bpm	>100 bpm
Grimace (reflex irritability)	No response	Grimace	Cry or Active withdrawal
Activity (motor tone)	Limp	Some flexion	Active motion
Respiration	Absent	Weak cry; hypoventilation	Good, crying

Neonatal Resuscitation Algorithm



Pulseless Arrest

Start CPR
Give Oxygen
Attach defibrillator, monitors

CPR
Rate: 100-120/min
Depth: Infant 1.5 in, Child 2-4 in
Compressions:breath Infant/child 15:2, Adolescent 30:2
Advanced airway 10 breaths per minute

Rhythm shockable?
Yes → VFib or Pulseless VTach
No → Asystole or PEA

Defibrillation*
1st shock: 2 J/kg
2nd shock: 4 J/kg [≤10 J/kg or adult dose]
Adult: 120J→150J→200J

Shock
CPR 2 min
IV/IO access

C

CPR 2 min
IV/IO access
Epinephrine 0.01 mg/kg [≤ 1 mg] IV/IO
– Repeat every 3-5min
Consider advanced airway

Rhythm shockable?
No
A
Yes
Shock
Resume CPR (2 min) *and*
Epinephrine 0.01 mg/kg [1mg if ≥50kg/≥18yo] IV/IO
– Repeat every 3-5 min
Consider advanced airway

Rhythm shockable?
No
B
Yes
Shock
Resume CPR (2 min) *and*
Amiodarone 5 mg/kg IV/IO*
– May repeat up to x2, *or*
Lidocaine 1 mg/kg IV/IO^
– *then* 20-50 mcg/kg/min gtt
Treat reversible causes

*In ACLS ≤ 300mg (1st dose), ≤ 150mg (2nd dose)
^In ACLS 1–1.5 mg/kg then 0.5–0.75 mg/kg

Rhythm shockable?
No
D
Yes
CPR 2 min
Treat reversible causes
Rhythm shockable?
No
Yes
Go to A or B

***Defibrillation**
▹ Turn SELECTOR SWITCH to "DEFIB"
▹ Using ENERGY SELECT, enter energy level (Joules)
▹ Stand clear, remove O_2. Press and hold "SHOCK"

Asystole/PEA: go to C or D
Organized rhythm: check pulse
Pulse present (ROSC): post-cardiac arrest care

Targeted Temperature Management (TTM)
Cardiac arrest, no response to verbal commands after ROSC

LPCH Pediatric

Tachycardia with Pulse and Poor Perfusion

▹ **Identify and treat underlying cause**
▹ Maintain patent airway; assist breathing as necessary
▹ Oxygen
▹ Monitors (Cardiac, BP, pulse Ox)
▹ IV/IO access
▹ 12-lead EKG (if available; don't delay therapy)

Narrow QRS (≤ 90ms) → Evaluate QRS duration ← Wide QRS (> 90ms)

Evaluate rhythm with 12-lead EKG or monitor

Probable Sinus Tachycardia
▹ Compatible Hx
▹ Known cause
▹ P waves present and normal
▹ Variable RR; constant PR
▹ Infant: <220 bpm
▹ Child: <180 bpm

Probable SVT
▹ Compatible Hx (nonspecific, vague); history of abrupt Δ HR
▹ P waves absent/abnormal
▹ HR not variable
▹ Infant: ≥ 220 bpm
▹ Child: ≥180 bpm

Possible Ventricular Tachycardia

Identify and treat cause

Consider vagal maneuvers*

Cardiopulmonary compromise?
Hypotension, acutely AMS, signs of shock
Yes / No

Synchronized Cardioversion
▹ Turn SELECTOR SWITCH to "DEFIB"
▹ Using ENERGY SELECT, enter 0.5–1 J/kg *[adult 100J]*
▹ Press "SYNC ON/OFF" button
Verify that white down arrows present above each R wave, "SYNC" message on display
▹ Stand clear, remove O_2. Press and hold "SHOCK" button
▹ If not effective, increase to 2 J/kg. *NOTE: You must press "SYNC ON/OFF" again*

▹ Cardiology consult advised
▹ If IV present, bolus **Adenosine**
  - ▹ 1st dose: **0.1 mg/kg** [≤6mg]
  - ▹ 2nd dose: **0.2 mg/kg** [≤12mg]
▹ If no access, or Adenosine ineffective **synchronized cardioversion**

If rhythm regular and QRS monomorphic, consider **Adenosine**
▹ 1st dose: 0.1 mg/kg [≤6mg]
▹ 2nd dose: 0.2 mg/kg [≤12mg]

Cardiology C/S advised

*Vagal maneuvers: Place cold plastic bag on face for 15-30 sec. or stimulate rectum with thermometer. In older children, encourage bearing down (Valsalva) for 15-20 sec. Carotid massage and orbital pressure should not be performed in children.

Consider possible causes (H's/T's):
▹ Hypovolemia
▹ Hypoxia
▹ Hypothermia
▹ [H+] ions (acidosis)
▹ Hypo-/Hyperkalemia
▹ Hypoglycemia
▹ Toxins
▹ Tamponade
▹ Tension PTX
▹ Thrombosis
▹ Trauma

Bradycardia with Pulse and Poor Perfusion

▹ **Identify and treat underlying cause**
▹ Maintain patent airway; assist breathing as necessary
▹ Oxygen
▹ Monitors (Cardiac, BP, pulse Ox)
▹ IV/IO access
▹ 12-lead EKG (if available; don't delay therapy)

Cardiopulmonary compromise?
Hypotension, acutely AMS, signs of shock

Yes → **Start CPR if HR < 60 bpm** with poor perfusion despite oxygenation and ventilation
No → ▹ Support ABCs ▹ Give Oxygen ▹ Observe ▹ Consider expert consultation

CPR
Rate: 100-120/min
Depth: Infant 1.5 in, Child 2-4 in
Compressions:breath Infant/child 15:2, Adolescent 30:2
Advanced airway 10 breaths per minute

Persistent bradycardia?
Yes
No

▹ Epinephrine 0.01 mg/kg IV/IO [≤1mg]
  - ▹ Repeat every 3-5 min
▹ Atropine 0.02 mg/kg IV/IO [min 0.1mg; max 0.5mg] for increased vagal tone or primary AV block
  - ▹ May repeat x1
▹ Consider transthoracic/transvenous pacing
▹ Treat underlying causes

If pulseless arrest develops, proceed to PALS algorithm (start CPR)

Consider possible causes (H's/T's):
▹ Hypoxia
▹ Hypothermia
▹ Hypervagotonia
▹ Hypovolemia
▹ Head injury/↑ICP
▹ Hypoglycemia
▹ Hypo-/Hyperkalemia
▹ [H+] ions (acidosis)
▹ Heart transplant
▹ Toxins
▹ Tamponade
▹ Tension PTX
▹ Thrombosis (coronary/pulmonary)
▹ Trauma

NEURO

Status Epilepticus

ABCs. *Start stopwatch*, 100% FiO_2 IV, monitors, BG
IV/IO established:
▹ **Lorazepam 0.1 mg/kg [≤4 mg] IV over 2 min**

No IV access:
▹ Midazolam 0.2 mg/kg [≤10 mg] IM/buccal/nasal
▹ Diazepam 0.3–0.5 mg/kg [≤20 mg] PR

Sz persists 5–10 min
▹ Repeat Lorazepam x1
▹ *and* Call for 2nd-line AED

Sz persists 10–20 min
▹ Fosphenytoin 20 mg/kg [≤1.5 g] IV/IM over 10 m
– S_2: ↓BP
▹ *and* Contact Neurology

Sz persists 20–40 min
▹ Levetiracetam 40–60 mg/kg [≤4.5 g] IV over 5–15 m
▹ Phenobarbital 20 mg/kg IV over 15 m
– S_2: ↓RR after benzos
▹ Valproic acid 20–40 mg/kg [≤3 g] IV over 10 m
– Caution in <2yo, liver/metabolic dz
▹ Consider RSI, Order EEG

W/up: BG, CBCd, Chem 10, LFTs, NH_3, VBG, b-HCG, Tox screen, ACT, aEEG, LEG, MRI vs CT. Neurology C/s advised.

Refractory Status: RSI, IPPV. Titrate drips to burst suppression on EEG and maintain for 24–48h. Consider central access, inotropes for ↓BP (pentobarb, propofol).
– Midazolam: 0.2 mg/kg load, then 0.05–2 mg/kg/hr gtt. Bolus 0.2 mg/kg prn breakthrough Sz. Titrate gtt ↑ by 0.05–0.1 q3-4h
– Pentobarbital: 5–10 mg/kg load, then 1–5 mg/kg/hr gtt
– Propofol: 1–2 mg/kg load, then 100–350 mg/kg/min gtt

LPCH Pathways

Special cases
<1mo: If seizure ≥10-15min, use Phenobarbital 20 mg/kg. If Sz ≥15-20m give adrnl 10 mg/kg. *See NICU protocol.*
<6mo: Consider PT/PTT, LDH, AAs, lactate, pyruvate, urine studies (UA, reducing substances, OAs, AAs).
<1yo: Consider Pyridoxine 100 mg IV if Sz ≥15min.
Fever: Antipyretics. Add BCx, UCx. If c/f meningitis, add Abx, Acyclovir. Consider LP.
Hypoglycemia: Slow IV bolus D10 2.5 mL/kg. First give Thiamine 100 mg IM/IV if adult or Hx malnutrition.
Hyponatremia: 3% NaCl 3–5 mL/kg.
Head trauma: Early stat head CT.
Ketogenic diet: No Propofol.
Toxin induced: Avoid Fosphenytoin, use Phenobarbital instead.

Increased ICP

ABCs, IV, O_2, monitors
Early NSG involvement when possible.

CPP = MAP – ICP
wnl ICP < 20 mmHg

Stabilization and management

▹ *RSI if refractory hypoxia, hypoventilation, GCS ≤8 or <12 and rapidly declining, loss of airway reflexes*
▹ HOB 30 degrees, head midline
▹ Rapidly correct if:
– ↓BP: Goal CPP > 40 infant, >50 child, >60 adolescent
– ↓O2: Goal SpO_2 ≥ 93
– ↑CO2: Goal $PaCO_2$ 35 – 40
▹ Identify, Tx:
– Fever
– Hgb <7
– Glucose <60
– Uncontrolled pain

If ICP remains >20 mmHg
▹ Bolus 3% NaCl 5 mL/kg [≤500mL] over 10–30 min (central preferred. PIV okay) *or* 23.4% NaCl 0.5 mL/kg [≤30mL] over 20 min (central line only) *or* Mannitol 0.25-1 g/kg over 20-30m
▹ Temporarily hyperventilate to $PaCO_2$ 30-35
▹ Neuroimaging per NSG
– If obstructive hydrocephalus present, discuss emergent EVD

If refractory
▹ 3% NaCl 0.1-1 mL/kg/hr, goal [Na] > 155
▹ D/w NSG *(decompressive craniectomy, EVD)*
▹ Pentobarbital coma: load 5-10 mg/kg IV, then 1-3 mg/kg/hr gtt. Order vasoactives to bedside for ↓ BP

If impending herniation

Sx: ↑BP with ↑/↓ HR, anisocoria, severe HA, coma, abnml resp pattern, hemiplegia, or flexor/extensor posturing

▹ Bolus 3% NaCl 5 mL/kg [≤500mL] *or* 23.4% NaCl 0.5 mL/kg [≤30mL] *and/or* IV Mannitol 0.25 – 1 g/kg
▹ Hyperventilate to clinical improvement as brief temporizing measure
▹ RSI with Etomidate + Rocuronium
– Consider Lidocaine 1 – 1.5 mg/kg [≤100mg] as premed to blunt ICP spike

Special cases
Seizure: Lorazepam 0.1 mg/kg IV [≤4mg]. Tx promptly. Start or ↑ AED.
High risk for Sz *(eg severe TBI, depressed Fx, parenchymal abnormality)*: consider AED PPx
Intubated: Avoid high PIP/PEEP if possible. Consider lidocaine 1–1.5 mg/kg IV or 2 mg/kg ETT 3–5 min before suctioning.
Trauma: Maintain C-collar during RSI. Confirm C-collar not too tight.
Unknown etiology: early stat head CT.
Vasogenic edema *(eg brain tumor, abscess, meningitis)*: Load Dexamethasone 1-2 mg/kg IV [≤10mg], then give 0.5 mg/kg q6h. Note: does not help cytogenetic edema *(eg stroke)* or widespread trauma *(eg TBI)*

CV

Nonsustained VTach (NSVT)

= ≥3 consecutive ventricular beats *(wide QRS)*, lasting ≤30 sec, with HR >100
– Often ASx, self-resolving, incidentally noted on cardiac telemetry
– Consider Chem 10, CBC, EKG, CXR

Cardiology C/S, especially if structural heart defect, multiple episodes, symptomatic, p/w syncope, or strong FH

Management: Identify and Tx if reversible causes
▹ *DDx:* **Electrolyte imbalance, malpositioned line, ↓BP, hypoxia, anemia, adverse drug effect, MI, HF**

Hypertensive Emergency

Life/organ threatening HTN *(eg AMS, HF)*
Typically SBP ≥30 > upper limit wnl

Drips
▹ Nitroprusside 0.5–10 mcg/kg/min gtt
– *Usual max = 3. Cyanide and thiocyanate toxicity risk. Send thiocyanate level if >4 mcg/kg/min or on drip ≥ 3-5days. Avoid in renal/hepatic dysfunction*
▹ Esmolol 500 mcg/kg over 1 min, then 50-200 mcg/kg/min gtt
– *Avoid in asthma, BPD, pheo*
▹ Clevidipine 0.5–1 mcg/kg/min gtt, ↑ by 0.5–1 every 2-10 min [max ≤10]
– *Adults: initial dose 1–2 mg/hr, typical 4–6 mg/hr [max ≤21 mg/hr]*

Non drips:
▹ Hydralazine 0.1–0.2 mg/kg IV/IM [≤20mg] q4-6h
▹ Labetalol 0.25–1 mg/kg IV [≤20mg] q4-6h
– *Avoid in asthma, BPD, pheochromocytoma*

Initial goal: ↓ **SBP by ≤ (Current SBP – 95th %ile) / 4**

W/up: Chem 7, CBC, UA, cycle BP q2min. Consider CXR, EKG, Echo, Kidney US, Tox, head CT

Hypertensive Urgency *ASx, no organ damage*
▹ Hydralazine 0.25 mg/kg PO [≤25mg] q6-12h prn
▹ Isradipine (Dynacirc) 0.05–0.1 mg/kg PO q6-8h [≤10mg]. *Effect in 2-3 hrs*

Acquired Long QT & Torsades

ABCs. Cardiac tele, PIV, Chem 10, EKG. Cards c/s
▹ Review meds
▹ Replete lytes: **K > 4, Mg > 2, iCa1.2 > LLN**

Torsades de pointes: assess hemodynamics, Tx promptly
Stable: Bolus IV magnesium sulfate 25–50 mg/kg [≤2g] over 15 min or faster as needed. Monitor BP
Unstable (*↓BP, AMS, chest pain, HF*): Immediate cardioversion / defibrillation. Can bolus IV Mag. If patient becomes pulseless ▹ PALS algorithm (start CPR)

$QT_c \geq 500$ ms

Moderate AF:
♀ >460 ms ♂ >450 ms

Most common ↑QT_c causes:
– **Meds, ↓K, ↓Mg**
Less common:
– ↓Ca, Tox, congenital

EKG warning signs of Torsades
– Ventricular ectopy
– T wave alternans
– AV block
– *or* QRS widening

$QT_c = \frac{QT}{\sqrt{RR}}$

Use Westley Score to determine croup severity

Croup / Post-Extubation Stridor

Definitive: Dexamethasone: IV/IM/PO x1
Mild Croup: 0.15–0.6 mg/kg [≤16mg] x1
Mod/Severe Croup: 0.6 mg/kg [≤16mg] x1
Post-Extubation: 0.25–0.5 mg/kg [≤10mg] q6h
Consider: Helios 80/20 (↓ to 70/30–60/40 for FiO_2) CPAP

Temporizing: Rac Epi 0.05 mL/kg [≤5ml] (2.25%), repeat PRN

Tip: For better dexamethasone taste, request IV formulation for PO use

RESP

Status Asthmaticus

ABCs, monitors, SpO_2 >92, PIV
Initial Tx:
▹ **Albuterol** 10-20 mg/hr continuous
– *or* 8 puffs MDI q1h x1-3
– *or* 2.5–5 mg Neb q20min x1-3
▹ **Ipratropium** neb 0.5–0.75 mg
▹ **Dexamethasone** 0.6 mg/kg [≤16mg] IV/PO
– *or* **Methylpred** 2 mg/kg [≤125mg] IV

LPCH Pathways

If poor response:
▹ **Magnesium sulfate** 25–50 mg/kg IV [≤2g] over 20 min

For extremis, can add Epinephrine 0.01 mg/kg [≤0.5mg] IM/SC q20m x3

If poor response:
▹ **HFNC** 0.5–2 lpm/kg [≤20-30] *or* **CPAP** 5 cm H_2O
– Make NPO, start D5 NS w/ LR at 1xMF. VBG, trend TCOM/$FiCO_2$
▹ **BiPAP** 10/5 x 14/6 x 16/8 x 20/10 cm H_2O
– If not tolerating NPPV, consider Precedex or Ketamine for anxiolysis
▹ **Terbutaline:** load 10 mcg/kg IV over 10 min, then 0.4 mcg/kg/min gtt
– Can ↑ by 0.25–0.5 mcg/kg/min [≤3] prn q30min
– Cardiac tele. Trend EKG, troponin q12h. S_2: May develop ↑K, ↓BP
– Caution β-agonists ≥20 mg/hr → ↑ risk arrhythmia. Consider bolusing NS/LR to ↓ HR
▹ **Aminophylline:** load 6 mg/kg IV, then 0.5–1 mg/kg/hr gtt
– Check drug level in 6-12h, titrate gtt to goal level 10-15 mcg/mL
▹ **Heliox:** mixture 80/20 $He:O_2$
– ↓ $He:O_2$ to 70/30 or 60/40 for ↑ FiO_2 requirement

If refractory
▹ *DDx:* consider foreign body, vocal cord paralysis, congenital *(rings, slings, laryngomalacia)*, mediastinal mass
▹ **Intubation**: consider Ketamine +/- Atropine +/- Rocuronium *(see RSI)*
▹ **IPPV**: Sedation with ketamine +/- midazolam. Avoid prolonged paralytics. Potential settings: volume control 8 cc/kg, max PIP 45cm, low RR, long E:time (I:E 2-4). Allow permissive hypercapnia, PEEP set at 1–2 cmH20 below auto-PEEP. Anticipate air leak, PTX. Ketamine 1 mg/kg IV q1h PRN suctioning *and/or* Lidocaine 1 mg/kg ETT q4h PRN suctioning to ↓ bronchospasm.
▹ Consider **isoflurane**. Consider **VV ECMO**.

Anaphylaxis

IM Epinephrine 0.01 mg/kg [≤0.3mg; ≤0.3mL]
▹ **Repeat q5-15min x1-3**
Attach monitors, FiO_2 100%, place recumbent, elevate BLEs

▹ If shock (poor perfusion, ↓BP): bolus 20 ml/kg NS/LR
– Repeat prn, monitor UOP
▹ If bronchospasm: Albuterol Neb 2.5–5 mg, repeat PRN
▹ If refractory anaphylaxis: Epinephrine gtt 0.1–1 mcg/kg/min
▹ Can also consider: IV Methylpred 1 mg/kg [≤125mg], IV Benadryl 1 mg/kg [≤50mg], IV Famotidine 0.5 mg/kg [≤20mg]

Biphasic reaction
15% of Pts, usually in ≤12h (reported up to 72h)

Labs: (optional) draw serum tryptase 15m–3h *and/or* histamine 15m–25m after onset of Sx

There is no contraindication to epinephrine in the setting of anaphylaxis

Bronchiolitis

Desats/Increased WOB:
– Consider congestion/nasal obstruction, mucus plugging. *1st line:* **reposition**, **suction** q2-4h + PRN
– *Stepwise escalation:* blowby O_2 PRN → 0.25–4 L NC → 0.5-2 L/kg HFNC → CPAP → BiPAP → intubation/IPPV

Dehydration
– Monitor UOP *(see vitals table for wnl by age)*, trend Wt QD
– If dry, bolus 20cc/kg. If no PO, D5 NS/LR at 1xMF

Notes
– Consider NPO if RR >70
– RVP and CXR are not routinely recommended
– If improving → worsening: can evaluate for AOM, consider CRP, CBCd, CXR, UA
– Routine albuterol not a/w shorter hospitalization. Can trial ACT if severe.

Hyperkalemia

Discontinue all K-containing IVF (including TPN)

Emergent Tx:

If no ECG changes:
▹ **Calcium Gluconate 60 mg/kg [≤3g]** IV over 5min *or* **Calcium Chloride 20 mg/kg [≤1g]** IV over 20min* *and*
▹ **Regular insulin 0.1 units/kg [≤ 10 units]** *with* **IV Dextrose** *central* over 30m. Check BG after 1h
<5yo: **5 mL/kg D10**
≥5yo: **2 mL/kg D25 [≤100mL]** *and*
▹ **Start non-emergent Tx** (reduce total K) *and*
▹ **Consider Sodium Bicarb 1 mEq/kg [≤ 50 mEq]**

If failed response:
▹ Repeat emergent Tx. Consider HD/CRRT

Indications for emergent Tx:
– EKG changes
– Muscle weakness/paralysis
– [K] > 7
– [K] > 6 and continued risk of ↑ (e.g. tumor lysis syndrome)

With: VBG w/ lytes, CBC, Chem 10, cardiac tele, can trend EKG

Common causes: hemolyzed sample, exogenous (IVF, TPN), renal failure, cell death (rhabdo, tumor lysis, crush injury, burn), metabolic acidosis, drug effect (spironolactone, ACE-I), CAH, adrenal insufficiency, hematoma

EKG changes: Peaked T-wave → PR and QRS prolongation → loss of P-wave → Sine wave

**Preferred in setting of cardiac arrest or impending arrest. May be infused more rapidly depending on scenario*

Non-emergent Tx:
▹ Correct reversible causes
▹ **Furosemide** 1–2 mg/kg IV/PO [≤40mg] q6-12h
▹ **Sodium polystyrene sulfonate** 1 g/kg PO/PR [≤30g] q6h
Avoid if bowel obstruction, post-operative, on opioids, ileus, preterm neonate. Check for drug-drug interactions

Hyponatremia

Chronic and/or Asymptomatic
– ↑ [Na] by 4–6 mEq/L over initial 24h
– Can generally correct using isotonic fluids
Severe Symptoms *(Sz, AMS, ↓RR)*
▹ 3% NaCl 3–5 mL/kg over 10–15m *(central preferred, PIV okay)*
– May ↑ serum [Na] by 2.5–4 mEq/L
Persistent Sx: Repeat 3% NaCl bolus x1-2
If central access: Infuse 3% NaCl at 1-2 mL/kg/hr until translation to isotonic fluids (NS, LR)

Rate of correction varies by duration of hyponatremia

Labs: Initially check [Na] q4-6 hours until trajectory established

Slow correction:
– ↑ [Na] by 6–8 mEq/L per day
– If high risk, ↑ [Na] by 4–6 mEq/L/day

Rapid correction:
– ↑ [Na] by 5 mEq/L over initial 3-4h, and ↑ by ≤ 8 mEq/L over initial 24h
– Then ↑ by 6–8 mEq/L per day

Dehydration/AKI

Management:
IV bolus 20 ml/kg NS or LR, repeat PRN
· Consider 5–10 ml/kg if cardiac Hx or Hgb < 7
· Avoid bolusing IV dextrose
Consider 20 ml/kg Pedialyte NG/GT if available

	Prerenal *AKI*	Intrinsic *ATN*	Postrenal *Obstruction*
Eg			
FENa	<1%	>1%	>4%
FEUrea	≤35%	>50%	N/a

Chem 7, urine Na + urine urea (w/ Cr)

Refeeding Syndrome

Management:
– Continuous tele, Chem 10, CBC, CK, EKG
– D/c feeds. Replete electrolytes. Monitor for HF, arrhythmia
– Before starting dextrose-containing fluids, give IV thiamine 100mg

Sx: **↓[Phos]**, ↓[K], peripheral edema, ↓[Mg], ↑ [glucose], CHF, Sz, rhabdo

– *At risk:* Anorexia nervosa, FTT, ↓↓/no nutrition for ≥5-10 days
– Highest mortality from **cardiac complications** *(resting HR >70 can be abnml in severe anorexia)*
– Consider **Wernickes** if AMS/ataxia/ocular dysfxn

GI

Upper GI Bleed

ABCs, 2 large IVs, CBC, T&S, NG lavage, NPO
▹ Start PPI:
– IV Pantoprazole 1 mg/kg [≤80mg] x1 *then* 0.1-0.2 mg/kg/hr [≤8mg/hr] gtt
– *or* Pantoprazole 1 mg/kg [≤40mg] BID
– *or* PO Omeprazole 1 mg/kg [≤20mg] BID
▹ Transfuse as needed
▹ Consider endoscopic repair, IR embolization

W/up: Chem 7 (↑*BUN*), LFTs, coags +/- lipase, H pylori, KUB. Abd US, endoscopy

DDx:
Esophageal varices, esophagitis, gastritis, ulcer, idiopathic, foreign body, Mallory Weiss, Dieulafoy's, AVM, IBD, vasculitis (HSP), pancreatitis, other sources of blood (e.g. hemoptysis, swallowed maternal blood)

Varices: if present, can add **Octreotide**: Load 1-2 mcg/kg [≤100mcg] IV, then 1–2 mcg/kg/hr gtt [≤50]. Monitor for ↓HR, ↓glucose. Taper over 24 hrs.

Acute Pancreatitis

Initial management:
– NPO. Bolus 20 ml/kg NS or LR
– Start 1.5–2xMF, titrate to UOP
– Replete calcium. Goal [glucose] < 200
– Manage pain. Consider PCA
– If appetite, no ileus, no N/V: can trial low fat, soft diet in first 24h, slowly ADAT
– Workup cause

W/up: CBCd, Chem 10, lipase, amylase, LFTs, CRP, triglyceride, b-HCG. Consider KUB, RUQ US, EtOH

Notes
– Sensitivity lipase > amylase. *Usually* ↑ *≥ 3x wnl*
– In adults, ↑ BUN trend over initial 24h a/w ↑ risk mortality
– Post-pyloric (NJ) feeds preferred to TPN. Do enteral nutrition if not tolerated (↑ abd pain, vomiting, bloating, diarrhea). Use low-fat high protein formula

HEME/ONC

Tumor Lysis Syndrome

▹ Start D5 NS/LR at 1.5—2x MF, maintain urine SG ≤ 1.010
▹ Chem 10 + uric acid q4-6h, LDH q24h. Space labs as able, Manage electrolyte abnormalities
▹ Allopurinol: start 24-48hrs before Chemo
▹ Rasburicase: 0.1-0.2 mg/kg [≤6mg] IV once if uric acid ≥8–10 mg/dL. Trend uric acid q6-12h until resolution of TLS

↑uric acid, ↑K, ↑Phos, ↓Ca, ↑LDH, uremia

At ↑ risk: high grade NH lymphoma (Burkitt's), ALL with WBC >100K, AML w/ WBC >50K, significant tumor burden, highly sensitive to chemo

Complications: acute renal failure, electrolyte abnormalities (hyperkalemia)

Consider furosemide for fluid overload, ↑K, ↑Phos

Transfusion

Fresh frozen plasma (FFP)
– **10–20 cc/kg** max ↑ Coags to > 30% wnl
– Minimal effect if INR < 1.7
– Give if transfusing ≥ ~105-120 cc/kg pRBC

Cryoprecipitate
– 1 unit/10 kg [≤12 units] over 30min
– May ↑ fibrinogen 60-100 mg/dL
– Commonly given for fibrinogen <150 + active bleeding or for fibrinogen <100 mg/dL

Massive Transfusion 1:1:1 of pRBC, Plt, FFP. *Activate massive transfusion protocol*
– C/b coagulopathy, dilutional ↓ Plt, hypothermia, citrate toxicity → ↓ [Ca2+], ↑ [K]
– Consider Tranexamic Acid (vs Amicar)
– If **trauma**: TXA 15 mg/kg [≤1g] load, then 2 mg/kg/hr [≤125 mg/hr] gtt for 8hr
– If severe/refractory **bleeding**, may consider recombinant factor VIIa 30–90 mcg/kg

pRBCs
– **10 cc/kg** over 2-4h
– May ↑ Hgb 2-3 gm/dL
– Usc **5 ml/kg** over 4h if initial Hgb <5

Platelets
– **1 unit/10 kg** [≤6 units] over 30-60m
– May ↑ Plt by 30-50K
– Use **10 cc/kg** if patient Wt < 10 kg
– Give if Plt <10 and either active bleeding or Onc Pt

ID

Febrile Neutropenia

ANC = WBC x (% Neuts + % Bg)

Start empiric Abx in < 30 min
– Standard: Cefepime
– Line infection/cellulitis: Cefepime + Vancomycin
– Abd infection: Pip/Tazo *or* Cefepime + flagyl
– Unstable, ill-appearing (toxic, ↓BP): Meropenem + Vancomycin (*see Sepsis*)

ANC < 500/mm³ *and* **Temp ≥ 38.3 C** *or* **≥ 38.0 C x2 in 24h**

W/up: CBCd stat, CRP, BCx (central line + peripheral), UA/UCx (bag or clean cath only) +/- CXR, RVP
– Target further w/up based on HPI, physical exam (including oral, perianal)

Avoid catheterization, rectal temp, PR meds

Sepsis / Septic Shock

Suspected Sepsis: Initial management **Total time: <60 min**
– Establish IV, FiO2 100%
– *In <5 min:* **1st 20 ml/kg NS bolus**. Vitals q5m. Call rapid.
– Labs: BG, CMP, CBCd, CRP, BCx, VBG, lactic acid, UA. T&S, coags Target additional w/up to identify source of sepsis.
– ***Start appropriate Abx in <60 min***

↓BP *or* **↑HR** *and* **↑RR**
▹ **2nd 20 ml/kg NS bolus**, re-evaluate

If persistent:
▹ **3rd 20 ml/kg NS bolus**
▹ Verify appropriate Abx started. Correct if ↓glucose, ↓Ca^{2+}

If persistent:
▹ Start peripheral epinephrine (0.05 – 0.3 mcg/kg/min)
▹ Obtain central access. Consider RSI (consider ketamine, rocuronium)
– Labs: Consider cortisol, central venous blood gas, lactate

If persistent:
▹ For **cold shock**: titrate epinephrine
▹ For **warm shock**: start central norepinephrine (0.05–0.3 mcg/kg/min). Echo
▹ Consider further imaging for source, consider other causes of shock

If persistent:
▹ Consider 10 ml/kg pRBC transfusion if Hgb <10
▹ Consider stress dose steroids *(see Adrenal Crisis)*

If persistent: **Catecholamine Resistant Shock.** Assure euvolemia.
▹ If **warm shock** and on norepi: consider epinephrine *vs* vasopressin
▹ If **cold shock**, ScvO2 <70%, Hgb >10, and on epi: add norepinephrine
– *Note:* if cold shock, swl BP, Scv <70%, Hgb >10, on epi: add milrinone

Shock
$DO_2 < VO_2$
inadequate oxygen delivery (DO_2) for cellular demands (VO_2)

Oxygen delivery
$DO_2 = CaO_2 \times CO$

Arterial oxygen content
$CaO_2 = Hgb(Sat)(1.34) + (PaO_2)(0.003)$

Cardiac Output
$CO = SV \times HR$

SIRS *if ≥ 2*
- Temp >38.5 C or <36 C
- Tachycardia *or* Bradycardia
- Tachypnea
- Abnml WBC for age *or* >10% IG

Sepsis *if*
- SIRS *and*
- Suspected infection

Septic Shock *if*
- Sepsis *and*
- CV dysfunction

ENDO

Adrenal Crisis

Hydrocortisone (Solu Cortef) IV/IM
(1) 50 mg/m² *or* 1–2 mg/kg [≤100 mg] x1 *then* *(2)* 12.5–25 mg/m² *or* 1 mg/kg [≤50 mg] q6h

In emergency, may use initial dosing:
0-3yo = 25mg 3-12y = 50mg ≥12yo = 100mg

Sx: ↓BP, shock, ↓[Na], ↑[K] +/- vomiting, diarrhea, abd pain, fever, AMS, ↓[glucose]

– Labs: BG, chem 7. Consider cortisol, ACTH before Tx (↑vs 2° adrenal insuf.). Admt w/ up for CAH
– Correct electrolytes, volume depletion, hypoglycemia

TOX

Poison Control: 1(800) 222-1222

Acetaminophen toxicity

N-Acetylcysteine (NAC):
– **IV** 150 mg/kg [≤15g] over 1hr, *then* 50 mg/kg [≤5g] over 4hr, *then* 100 mg/kg [≤10g] over 16hr *then* repeat as needed
– **PO/NG** 140 mg/kg x1, *then* 70 mg/kg q4h x17

Consider stopping NAC when:
(1) Pt ASx *(2)* APAP <10/undetectable *and* *(3)* ALT < 50% peak

Add **Activated Charcoal** 1 g/kg [≤50g] **if < 4h ingestion of > 150 mg/kg** *(unless GI obstruction or aspiration risk)*

Benzodiazepine overdose

Caution: risks of reversal often outweigh benefits. Reversal can provoke seizures, particularly if Hx BZD exposure or ↓ Sz threshold. Apply clinical judgement

Sx (isolated BZD OD): ↓CNS, wnl vitals

DDx:
Co-ingestant (esp if ↓RR), hypoglycemia, trauma, encephalitis

Flumazenil 0.01 mg/kg IV [≤0.2 mg] over 15 sec
– May repeat 0.005-0.01 mg/kg [≤0.2 mg] x4 *(max ≤ 1 mg)*
– Peak effect: 6-10 min
– Duration: 45-75 min

Narcotic overdose

Sx: ↓RR, ↓Temp, ↓HR, ↓BP, pinpoint pupils

Naloxone IV/IM
▹ Partial reversal: 1-5 mcg/kg
▹ Full reversal: 0.1 mg/kg [≤2mg/dose]

– Naloxone half-life: 60–90 min
– Repeat dose q30–60 min PRN

Serotonin Syndrome

Initial management
– Monitors, PIV, d/c serotonergics
– Sedate: Lorazepam 0.02-0.04 mg/kg IV [≤2mg]
▹ Repeat q10min PRN
▹ SpO_2 ≥94, IVF, cardiac tele
– *Then* if persistent Sx, consider Cyproheptadine

Sx: Tremor, MS ΔΔ, ↑DTRs, ↑HR, ↑BP, ↑Temp, ↑diaphoresis, clonus

– W/up: CBC, Chem 7, LFTs, coags, creatinine phosphokinase, BCx, UA, CXR, CT head, LP
– *Common causes:* MAOI, SSRI, meperidine, dextromethorphan (DayQuil), MDMA
– Avoid Acetaminophen

ETHICS

Informed Consent
I. Disclose relevant information
II. Recommend a plan
III. Assess for understanding of I and II
IV. Elicit decision
V Document consent *(if applicable)*

– Clinical issue
– Risks
– Alternatives
– Consequences

DKA

ABCs, monitors, 2 PIVs. Labs
(1) Bolus 10-20 ml/kg NS or LR (over 1 hour) *then*
(2A) Start insulin gtt:
– Consider 0.05 units/kg/hr for <5yo
– Consider 0.1 units/kg/hr for ≥5yo *and*
(2B) Start 1.5xMF using 2 bag system:
– **Bag 1:** NS + 20 KCl + 20 KPhos
– **Bag 2:** D10 NS + 20 KCl + 20 KPhos
– Only start Bag 2 when: glucose < 300 *or* glucose dropping > 100 mg/dL/hr
– ***Potassium:*** If initial [K] >5.5, and non-hemolyzed, hold K in fluids until serum [K] <5.5
(3) After 4-6h on 2 bag system:
– If ↑ [Na], can change to ½ NS
– If ↑ [Cl], can change to acetate-containing fluids or ½ NS

Cerebral edema: #1 cause of mortality. Monitor and Tx promptly if Sx of ↑ ICP. *At ↑ risk:* initial $PaCO_2$ or ↑BUN.
▹ 3% **NaCl 3-5 cc/kg** IV *(PIV ok)*. Can also give Mannitol 0.5–1 g/kg IV over 20-30 min, may repeat in 30 min prn
▹ NSG c/s. Consider CT head
▹ R/o ↓ [glucose] and ↓ [Na]

Definition:
1. Serum glucose > 200 mg/dL
2. Metabolic acidosis (venous pH <7.3 *or* HCO_3 <15) *and*
3. Ketosis (≥2+ ketonuria *or* β-hydroxybutyrate ≥3)

Severity: by venous pH
– Mild < 7.3 – 7.2
– Moderate < 7.2 – 7.1
– Severe < 7.1

Labs: glucose POC q1, VBG q4, Chem 10 q4, UA, β-hydroxybutyrate, HbA1c, CBCd, CRP
Alternate VBG/Chem 10 q2h

Corrected Sodium:
= [Na] + (2 x $\frac{\text{Glucose} - 100}{100}$)

If corrected Na <140: increase frequency of sodium monitoring

Repletion of Mg, HCO_3 not routine

Hypoglycemia

PO: Carb *(eg fruit juice)* x1-2, recheck BG in 15-30min
IV: *(1)* Slow bolus 2.5 mL/kg D10 *(preferred)* *or* 1 mL/kg D25
then (2) Infuse 3-5 mL/kg/hr D10. Check BG q30-60min until stable *(70-120)*

For BGs <45, draw critical labs before Tx if possible:
– Labs *(in vic)*: CMP, insulin, β-hydroxy, cortisol, GH, C-peptide, FFAs, lactate, acylcarnitine, NH_3, urine OAs
– *Note:* If PIV extravasates, ↑ [glucose] → ↑ tissue injury